Combined limit for searches for 1st generation LQ

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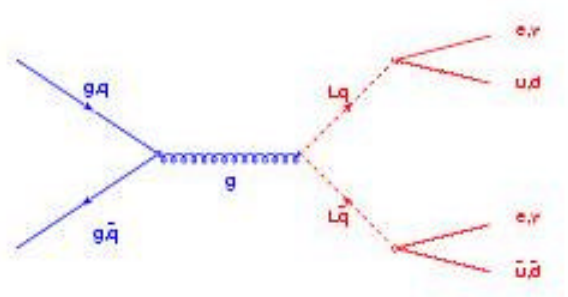
-Blessing-

LQ at the TeVatron

- Production
  - qg $\rightarrow$ LQ + LQbar
  - gg $\rightarrow$ LQ + LQbar
  - qqbar $\rightarrow$ LQ + LQbar



- Decay
  - LQLQ $\rightarrow$ l^+l^-qq, $l^{\pm}nqq$, $nnqq$

β = Br(LQ->eq)

- Experimental signature:
  - High pt isolated leptons (and/or MET) + jets

LQ search in eejj

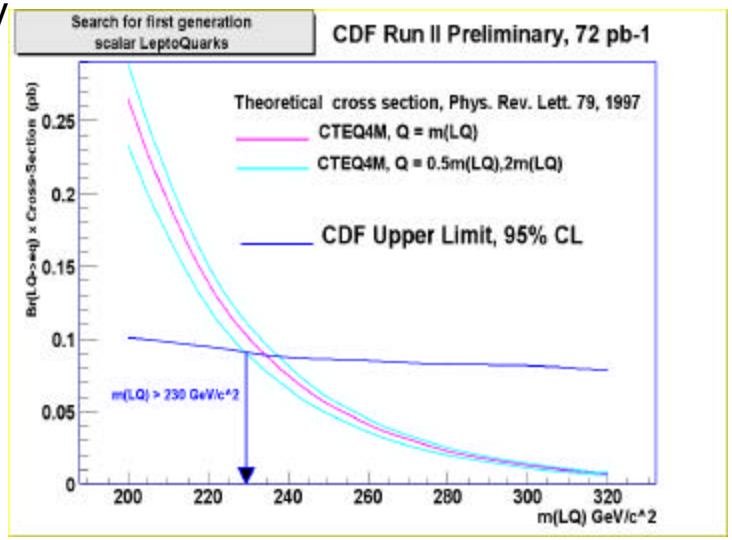
Signature: 2 electrons and 2 jets

Analysis cuts

- 2 central electrons with E_T > 25 GeV
- 2 jets with $E_T(j1)$ > 30 and $E_T(j1)$ > 15 GeV
- removal of events with 76 < M_{ee} < 110 GeV
- $E_T(j1) + E_T(j2) > 85$ GeV && $E_T(e1) + E_T(e2) > 85$ GeV
- Ö($(E_T(j1) + E_T(j2))^2 + (E_T(e1) + E_T(e2))^2$) > 200 GeV

0 events seen after analysis cuts

Consistent with background expectation



LQ search in evjj

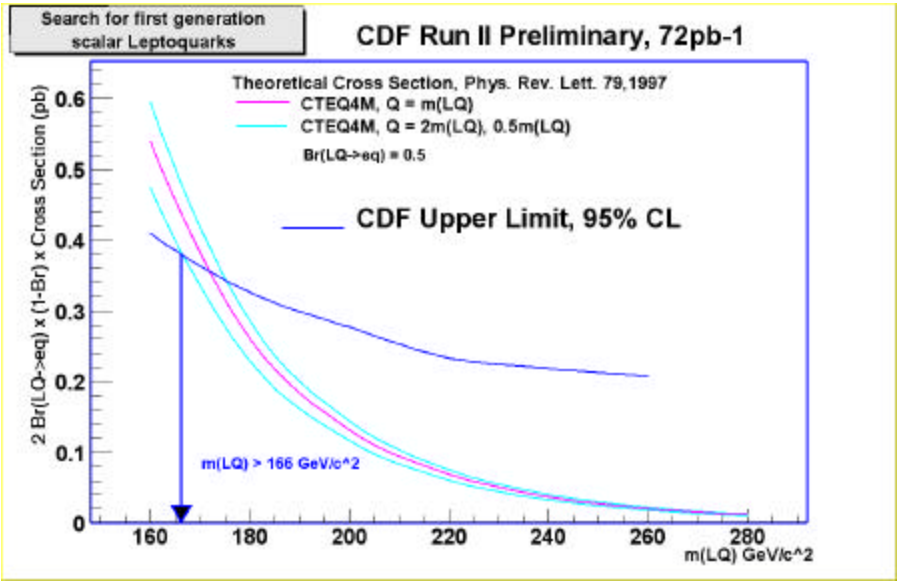
Signature: 1 electron, 2 jets and large MET

Analysis cuts

- 1central electrons with E_T > 25 GeV and MET > 35 GeV
- 2 jets with E_T > 30 GeV
- $\Delta\phi$ (MET-jet) > 10°
- $E_T(j1) + E_T(j2)$ > 80 GeV
- $M_T(e\text{-}\nu)$ > 120
- Met/$\sqrt{\Sigma E_T}$ > 4.5

2 events survive analysis cuts

Consistent with background expectation

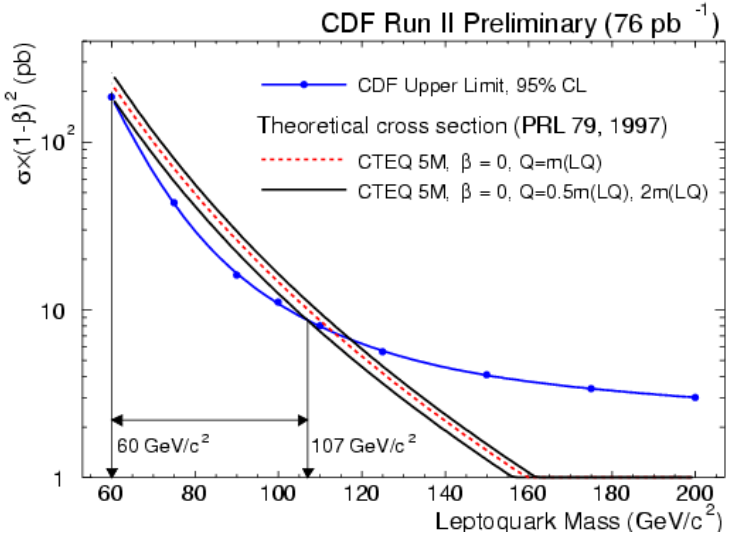


LQ search in ννjj

Signature: Large MET and 2 jets

Analysis cuts

- MET > 55 GeV
- 2 or 3 jets
  - E_T(jet1) > 40 GeV, E_T(jet2) > 25 GeV, E_T(jet3) > 7 GeV
  - $|\eta_{1/2}|<1$; $|\eta_3|<2.5$
  - No other jet with E_T > 7 GeV
- $100^o < \Delta\phi$ (MET-jet1/2) > 165°
- $80^o < \Delta\phi$ (jet1-jet2) > 165°
- $30^o < \min\Delta\phi$ (MET-jet2/3) > 135°
- Lepton veto
- 0.1 < Jet Em Fraction < 0.9
- min # of tracks in jet ≥ 4



42 events seen after analysis cuts

Consistent with background expectation

Combination method

- Joint likelihood formed from the product of the individual channels likelihood.
- For each mass we simulated 10K pseudo-experiments, smearing the calculated number of background events and the estimated number of signal events by their respective total uncertainties.
- The searches in the eejj and evjj channel use common criteria and sometime apply the same kind of requirements (for example on the tight electron identification) so the uncertainties in the acceptances have been considered completely correlated (which gives the most conservative limit).
- When calculating the limit combination including also the ννjj channel the uncertainties in the acceptances have been considered uncorrelated.A correlation factor of 0.5 has also been considered (no difference)

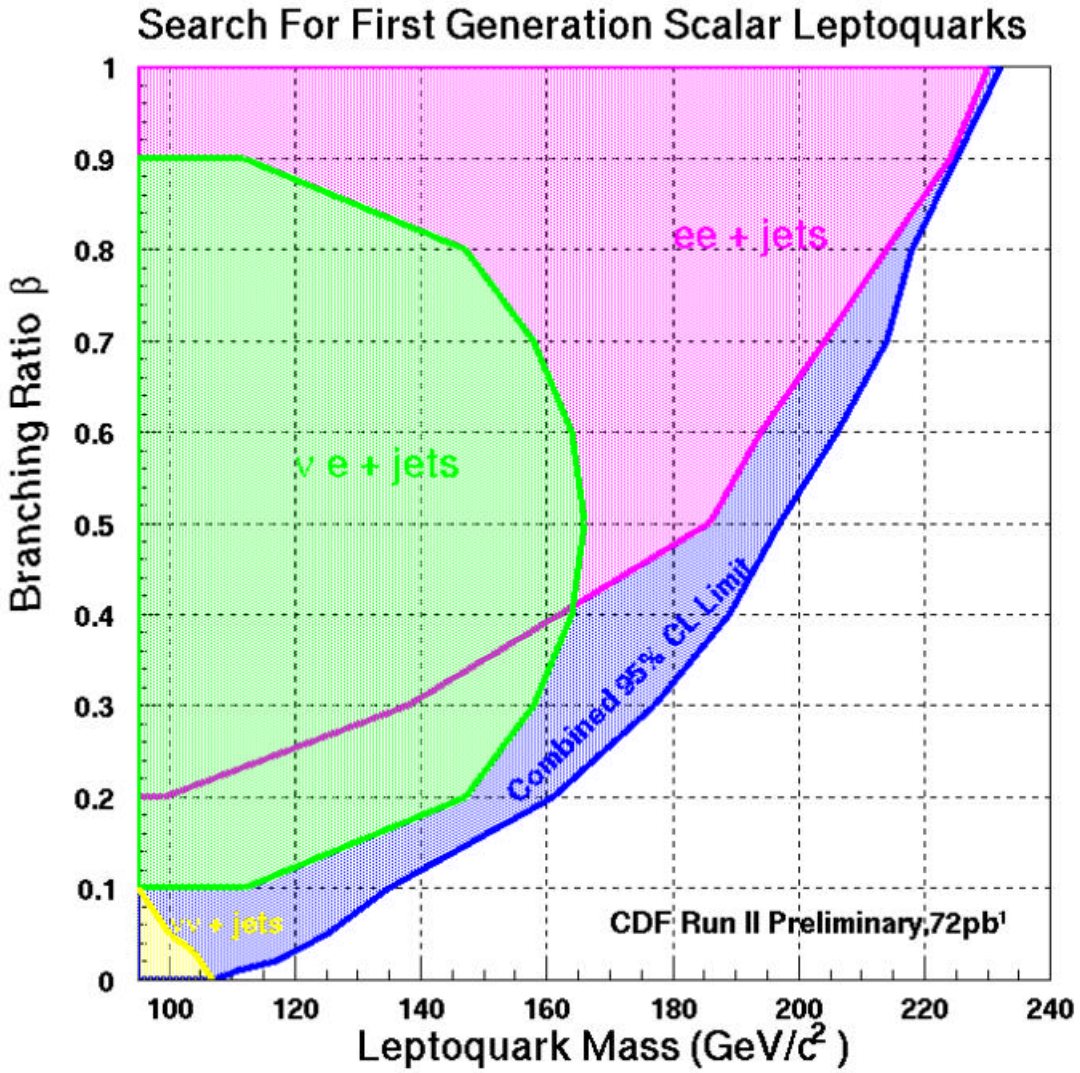
$$\sigma_{LIM} = N_{LIM}/(\varepsilon_{average} \times L)$$

- $\varepsilon_{average} = (\beta^2\varepsilon(eejj) + 2\beta(1-\beta)\varepsilon(evjj) + \beta^2\varepsilon(ee \text{ as } ev))$ for the 2 channels case and
- $\varepsilon_{average} = (\beta^2\varepsilon(eejj) + 2\beta(1-\beta)\varepsilon(evjj) + (1-\beta)^2\varepsilon(\nu\nu jj) + \beta^2\varepsilon(ee \text{ as } ev))$ for the three channels case.

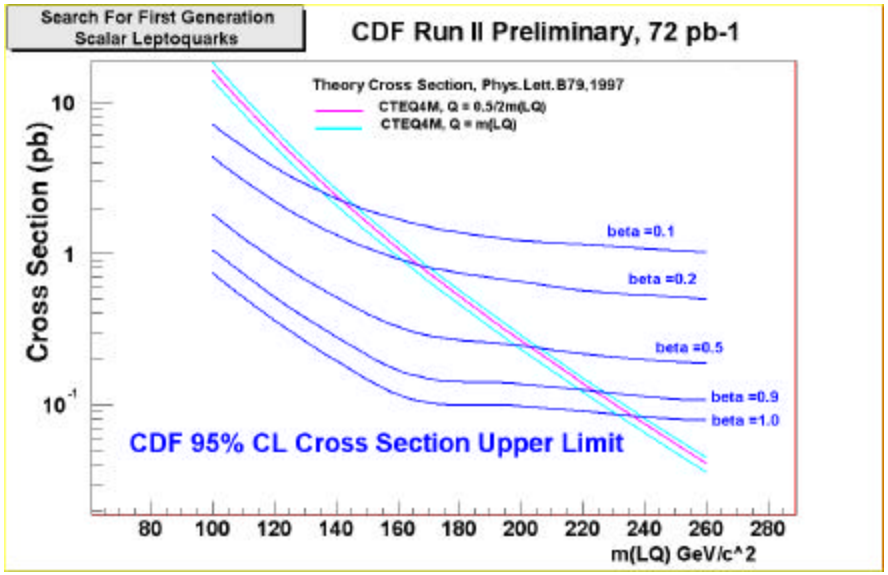
$L = 72 pb^{-1}$

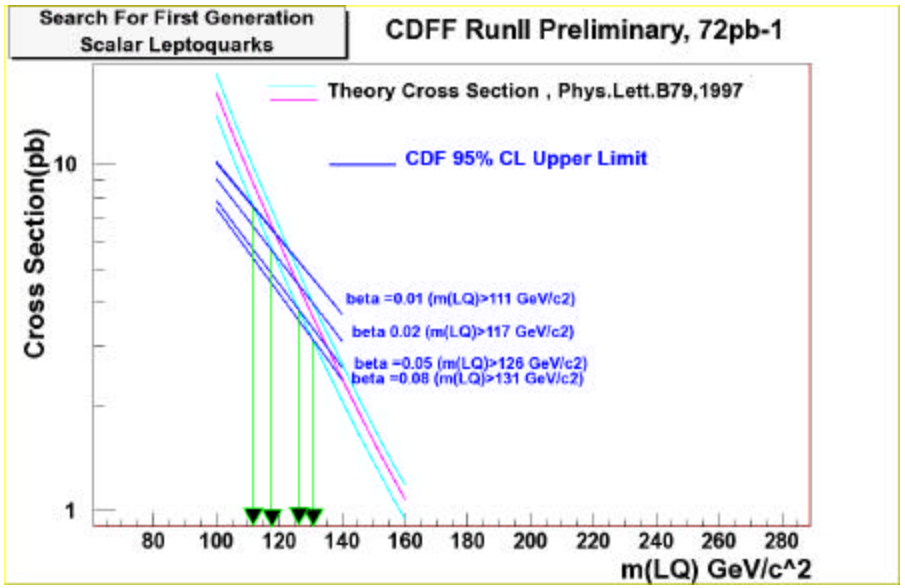
Result

111GeV/c^2 (β =0.01)
124GeV/c^2 (β =0.05)
135 GeV/c^2 (β =0.1)
161 GeV/c^2 (β =0.2)
197 GeV/c^2 (β =0.5)
232 GeV/c^2 (β =1.0)



Results


Search For First Generation
Scalar Leptoquarks
CDF Run II Preliminary, 72 pb-1
Theory Cross Section, Phys.Lett.B79,1997
CTEQ4M, Q = 0.5/2m(LQ)
CTEQ4M, Q = m(LQ)
beta =0.1
beta =0.2
beta =0.5
beta =0.9
beta =1.0
CDF 95% CL Cross Section Upper Limit
Cross Section (pb)
10
1
10^-1
80 100 120 140 160 180 200 220 240 260 280
m(LQ) GeV/c^2


Search For First Generation
Scalar Leptoquarks
CDFF RunII Preliminary, 72pb-1
Theory Cross Section , Phys.Lett.B79,1997
CDF 95% CL Upper Limit
beta =0.01 (m(LQ)>111 GeV/c2)
beta 0.02 (m(LQ)>117 GeV/c2)
beta =0.05 (m(LQ)>126 GeV/c2)
beta =0.08 (m(LQ)>131 GeV/c2)
Cross Section(pb)
10
1
80 100 120 140 160 180 200 220 240 260 280
m(LQ) GeV/c^2

Conclusions

- We have performed the combination of all the CDF searches for first generation scalar letpoquarks using Run II data.
- The results are combined using a procedure based on a Bayesian approach which takes into account the correlations in the systematic uncertainties.
- We set 95% CL lower limit for scalar first generation leptoquarks at

$111\ \mathrm{GeV}/c^2$ ($\beta = 0.01$),

$135\ \mathrm{GeV}/c^2$ ($\beta = 0.1$),

$161\ \mathrm{GeV}/c^2$ ($\beta = 0.2$),

$197\ \mathrm{GeV}/c^2$ ($\beta = 0.5$)

$232\ \mathrm{GeV}/c^2$ ($\beta = 1.0$).